CLAIMS

What is claimed is:

1. A sensing apparatus, including:

at least one sensor cell configured to produce a sensor current indicative of a sensed value; and

a readout circuit having an input node coupled to receive the sensor current, wherein the readout circuit also includes:

an output node; and

output voltage generation circuitry between the input node and the output node, wherein the output voltage generation circuitry is configured to generate an output voltage indicative of the sensed value in response to the sensor current while clamping the input node at a potential that is at least substantially fixed.

2. The sensing apparatus of claim 1, wherein the output voltage generation circuitry includes:

at least one circuit element; and

a differential pair coupled and configured to provide feedback to the at least one circuit element to reduce voltage excursion at the input node during generation of the output voltage.

3. The sensing apparatus of claim 2, wherein the at least one circuit element is a load transistor coupled to the differential pair.

4. The sensing apparatus of claim 1, wherein the output voltage generation circuitry includes:

an op amp having an input coupled to the input node and an output; and

at least one circuit element coupled between the output of the op amp and the input node and configured to provide feedback from output of the op amp to the input node.

5. The sensing apparatus of claim 4, wherein the input of the op amp is an inverting input, the op amp also has a noninverting input, and the at least one circuit element is a resistor coupled between the inverting input and the output of the op amp.

6. The sensing apparatus of claim 4, wherein the input of the op amp is an inverting input, the op amp also has a noninverting input, and the at least one circuit element is a transistor having a channel terminal coupled to the inverting input and a gate coupled to the output of the op amp.

7. The sensing apparatus of claim 1, also including:

a sensor cell; and

a column line, wherein the input node is coupled by the column line to the sensor cell, and wherein the output voltage generation circuitry also includes:

a readout capacitor coupled to the output node, and the output voltage generation circuitry is configured to charge the readout capacitor to a voltage indicative of the sensed value while clamping the input node at a potential that is at least substantially fixed.

8. A sensing apparatus, including:

at least one sensor cell configured to assert a sensor current indicative of a sensed value; and

a readout circuit having an input node coupled to receive the sensor current, wherein the readout circuit also includes:

a capacitor; and

charging circuitry coupled and configured to charge the capacitor to an output voltage indicative of the sensed value in response to the sensor current while clamping the input node at an at least substantially fixed potential.

9. The sensing apparatus of claim 8, also including:

a column line coupled to, and extending between, the input node of the readout circuit and the sensor cell.

10. The sensing apparatus of claim 9, also including:

at least one additional sensor cell coupled to the column line.

11. The sensing apparatus of claim 9, wherein the sensor cell comprises at least one sensor configured to assert the sensor current to the column line.

12. The sensing apparatus of claim 11, wherein the sensor is an image sensor.

13. The sensing apparatus of claim 8, wherein the sensor cell comprises:

at least one sensor configured to assert a raw output indicative of the sensed value to a first node; and

cell circuitry coupled to the first node and operable to assert the sensor current to the input node in response to the raw output.

14. The sensing apparatus of claim 13, wherein the sensor is an image sensor.

15. The sensing apparatus of claim 14, wherein the image sensor is a photodiode.

16. The sensing apparatus of claim 13, wherein the cell circuitry includes a source follower including a transistor whose gate is coupled to the first node.

17. The sensing apparatus of claim 8, wherein the charging circuitry includes:

a current mirror coupled to the input node and configured to draw a mirrored current in response to the sensor current while clamping the input node at the at least substantially fixed potential; and

additional circuitry, coupled to the current mirror and having a capacitor-charging node, wherein the additional circuitry is operable to provide charging current determined by the mirrored current from the capacitor-charging node to the capacitor.

18. The sensing apparatus of claim 17, wherein the current mirror is a Wilson current mirror.

19. The sensing apparatus of claim 17, wherein the current mirror applies a non-unity gain to the sensor current, so that the mirrored current is not identical to the sensor current.

20. The sensing apparatus of claim 17, wherein the current mirror is configured to draw the mirrored current from the capacitor-charging node, the additional circuitry is configured to convert the mirrored current to a charging voltage, and the charging current provided by the additional circuitry from the capacitor-charging node to the capacitor is determined by the charging voltage.

21. The sensing apparatus of claim 20, wherein the sensor cell comprises:

a sensor configured to assert a raw output indicative of the sensed value to a first node; and

cell circuitry coupled to the first node and operable to assert the sensor current to the input node in response to the raw output, wherein the cell circuitry includes a source follower including a first transistor whose gate is coupled to the first node, and wherein the additional circuitry includes:

a second transistor coupled to the capacitor-charging node and configured to provide the charging current in response to the charging voltage.

22. The sensing apparatus of claim 21, wherein the cell circuitry is configured to bias the sensor to an initial state by asserting a reference potential to the first node, the first transistor is biased to operate in a first regime when the first node is at the reference potential, and the second transistor is biased to operate in a regime at least substantially identical to the first regime when the additional circuitry operates to provide the charging current from the capacitor-charging node to the capacitor.

23. A sensing apparatus, including:

at least one sensor cell configured to assert a sensor current indicative of a sensed value; and

a readout circuit having an input node coupled to receive the sensor current, wherein the readout circuit also includes:

a current mirror coupled and configured to draw a mirrored current in response to the sensor current; and

additional circuitry, coupled to the current mirror, and configured to generate an output indicative of the sensed value in response to the mirrored current.

24. The sensing apparatus of claim 23, wherein the current mirror is configured to provide feedback to the input node.

25. The sensing apparatus of claim 24, wherein the current mirror is a Wilson current mirror.

26. The sensing apparatus of claim 23, wherein the current mirror is configured to draw the mirrored current in response to the sensor current while clamping the input node at an at least substantially fixed potential.

27. The sensing apparatus of claim 26, wherein the additional circuitry includes:

a capacitor; and

charging circuitry coupled to the capacitor and operable to charge the capacitor to an output voltage indicative of the sensed value in response to the mirrored current.

28. The sensing apparatus of claim 23, wherein the current mirror is a Wilson current mirror.

29. The sensing apparatus of claim 23, wherein the current mirror applies a non-unity gain to the sensor current, so that the mirrored current is not identical to the sensor current.

30. The sensing apparatus of claim 23, wherein the additional circuitry includes:

a capacitor; and

charging circuitry coupled to the capacitor and having a capacitor-charging node, wherein the current mirror is configured to draw the mirrored current from the capacitor-charging node, the charging circuitry is configured to convert the mirrored current to a charging voltage, and the charging circuitry is operable to provide charging current determined by the charging voltage from the capacitor-charging node to the capacitor.

31. The sensing apparatus of claim 23, wherein the additional circuitry includes:

a capacitor; and

charging circuitry coupled to the capacitor and having a capacitor-charging node, wherein the charging circuitry is operable to provide charging current determined by the mirrored current from the capacitor-charging node to the capacitor.

32. A sensing apparatus, comprising:

an array of sensor cells arranged in rows along a set of column lines; and

a set of readout circuits, each of the readout circuits coupled to a different one of the column lines to receive a sensor current indicative of a sensed value from at least one of the sensor cells coupled to said one of the column lines,

wherein each of the readout circuits includes:

an input node coupled to said one of the column lines to receive the sensor current;

a current mirror coupled and configured to draw a mirrored current in response to the sensor current; and

additional circuitry, coupled to the current mirror, and configured to generate an output indicative of the sensed value in response to the mirrored current.

33. The sensing apparatus of claim 32, wherein the current mirror is configured to provide feedback to the input node.

34. The sensing apparatus of claim 33, wherein the current mirror is a Wilson current mirror.

35. The sensing apparatus of claim 32, wherein the current mirror is configured to draw the mirrored current in response to the sensor current while clamping the input node at an at least substantially fixed potential.

36. The sensing apparatus of claim 35, wherein the current mirror is a Wilson current mirror.

37. The sensing apparatus of claim 35, wherein the array of sensor cells is an array of VCF sensor groups, and each of the VCF sensor groups includes at least two photodiode sensors.

38. The sensing apparatus of claim 32, wherein the additional circuitry includes:

a capacitor; and

charging circuitry coupled to the capacitor and operable to charge the capacitor to an output voltage indicative of the sensed value in response to the mirrored current.

39. The sensing apparatus of claim 32, wherein the current mirror applies a non-unity gain to the sensor current, so that the mirrored current is not identical to the sensor current.

40. The sensing apparatus of claim 32, wherein the additional circuitry includes:

a capacitor; and

charging circuitry coupled to the capacitor and having a capacitor-charging node, wherein the current mirror is configured to draw the mirrored current from the capacitor-charging node, the charging circuitry is configured to convert the mirrored current to a charging voltage, and the charging circuitry is operable to provide charging current determined by the charging voltage from the capacitor-charging node to the capacitor.

41. The sensing apparatus of claim 32, wherein the additional circuitry includes:

a capacitor; and

charging circuitry coupled to the capacitor and having a capacitor-charging node, wherein the charging circuitry is operable to provide charging current determined by the mirrored current from the capacitor-charging node to the capacitor.

42. A sensing apparatus, comprising:

an array of sensor cells arranged in rows along a set of column lines; and

a set of readout circuits, each of the readout circuits coupled to a different one of the column lines to receive a sensor current indicative of a sensed value from at least one of the sensor cells coupled to said one of the column lines,

wherein each of the readout circuits includes:

an input node coupled to said one of the column lines to receive the sensor current;

a capacitor; and

charging circuitry coupled and configured to charge the capacitor to an output voltage indicative of the sensed value in response to the sensor current while clamping the input node at an at least substantially fixed potential.

43. The sensing apparatus of claim 42, wherein each of the sensor cells comprises a sensor configured to assert the sensor current to one of the column lines.

44. The sensing apparatus of claim 43, wherein the sensor is an image sensor.

45. The sensing apparatus of claim 42, wherein the each of the sensor cells comprises:

a sensor configured to assert a raw output indicative of the sensed value to a first node; and

cell circuitry coupled to the first node and operable to assert the sensor current to one of the column lines in response to the raw output.

46. The sensing apparatus of claim 45, wherein the sensor is an image sensor.

47. The sensing apparatus of claim 46, wherein the image sensor is a photodiode.

48. The sensing apparatus of claim 45, wherein the cell circuitry includes a source follower including a transistor whose gate is coupled to the first node.

49. The sensing apparatus of claim 42, wherein the charging circuitry includes:

a current mirror coupled to the input node and configured to draw a mirrored current in response to the sensor current while clamping the input node at the at least substantially fixed potential; and

additional circuitry, coupled to the current mirror and having a capacitor-charging node, wherein the additional circuitry is operable to provide charging current determined by the mirrored current from the capacitor-charging node to the capacitor.

50. The sensing apparatus of claim 49, wherein the current mirror applies a non-unity gain to the sensor current, so that the mirrored current is not identical to the sensor current.

51. The sensing apparatus of claim 49, wherein the current mirror is configured to draw the mirrored current from the capacitor-charging node, the

additional circuitry is configured to convert the mirrored current to a charging voltage, and the charging current provided by the additional circuitry from the capacitor-charging node to the capacitor is determined by the charging voltage.

52. The sensing apparatus of claim 51, wherein each of the sensor cells comprises:

a sensor configured to assert a raw output indicative of the sensed value to a first node; and

cell circuitry coupled to the first node and operable to assert the sensor current to said one of the column lines in response to the raw output, wherein the cell circuitry includes a source follower including a first transistor whose gate is coupled to the first node, and wherein the additional circuitry includes:

a second transistor coupled to the capacitor-charging node and configured to provide the charging current in response to the charging voltage.

53. The sensing apparatus of claim 52, wherein the cell circuitry is configured to bias the sensor to an initial state by asserting a reference potential to the first node, the first transistor is biased to operate in a first regime when the first node is at the reference potential, and the second transistor is biased to operate in a regime at least substantially identical to the first regime when the additional circuitry operates to provide the charging current from the capacitor-charging node to the capacitor.

54. A method for reading out a sensor cell, comprising the steps of:

(a) asserting a sensor current, indicative of a sensed value, from the sensor cell to an input node of a readout circuit; and

(b) operating the readout circuit in response to the sensor current to generate an output voltage indicative of the sensed value while clamping the input node at a potential that is at least substantially fixed.

55. The method of claim 54, wherein step (b) also includes the step of charging a capacitor to a voltage indicative of the sensed value.

56. The method of claim 54, wherein step (b) includes the step of:

operating a differential pair to assert the output voltage to an output node coupled to a capacitor while providing feedback from the output node via at least one circuit element to the input node.

57. The method of claim 56, wherein step (b) includes the step of:

operating the differential pair to assert the output voltage to the output node while providing feedback from the output node via a load transistor to the input node.

58. The method of claim 54, wherein step (b) includes the step of:

operating an op amp to assert the output voltage to an output node of the op amp while providing feedback from the output node of the op amp to the input node, wherein the output node of the op amp is coupled to a capacitor.

59. The method of claim 54, wherein step (b) includes the steps of:

generating a mirrored current in response to the sensor current;

converting the mirrored current to a charging voltage; and

charging a capacitor to the output voltage in response to the charging voltage.

60. The method of claim 54, wherein the mirrored current is not identical to the sensor current.

61. The method of claim 60, wherein the mirrored current is greater than the sensor current.

62. A method for reading out a sensor cell, comprising the steps of:

(a) asserting a sensor current, indicative of a sensed value, from the sensor cell to an input node of a readout circuit;

(b) operating the readout circuit to generate a mirrored current in response to the sensor current; and

(c) operating the readout circuit to generate an output indicative of the sensed value in response to the mirrored current.

63. The method of claim 62, wherein step (b) includes the step of operating the readout circuit to generate the mirrored current while clamping the input node at a potential that is at least substantially fixed.

64. The method of claim 62, wherein the mirrored current is not identical to the sensor current.

65. The method of claim 64, wherein the mirrored current is greater than the sensor current.